Space Weather Technical Forecast

Issued on Thursday, 06 June 2024 at 00:13 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Moderate solar activity is likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate with two M-flares observed from AR3697, peaking M3.4 at 05/0856 UTC, followed by M2.6 at 05/1007 UTC. There are currently eleven sunspot regions on the visible disc. AR3697 remains the most complex region, with recent reconfiguration of the intermediate spots. In addition, there are suggestions it is trying to form a new delta region in the trailing area. Significant magnetic looping persists above the spot, and notable flares remain possible from this region. Some slight growth has also been observed in the intermediate region of AR3698 in the northwest, however this region currently remains stable. Growth of intermediate spots and an increase in magnetic flux has also been observed in AR3703, with this appearing to develop a small delta spot in its trailing region. Some flaring and magnetic looping has been observed from the southeast limb, suggesting a potential new region could arrive in the next 24 hours or so. Across the rest of the disc the majority of spots remain simple and stable.

No Earth directed CMEs are currently thought to have occurred, although a filament eruption from the northeast is being assessed, however this is thought likely to miss Earth.

Solar Wind / Geomagnetic Activity: Solar winds observed by ACE at L1, were slightly enhanced, perhaps attributable to a weak CME glance that was expected, but it could also have been the effects of a solar sector boundary crossing. Wind speeds were slightly elevated between 400-500 km/s, but eased to background levels after 05/1600 UTC. Density rose after this slight enhancement, from below average levels to above average by 05/1200 UTC, before gradually easing to average once again. Interplanetary Magnetic Field (IMF), Bt, remained weak, at 7nT or below, with the north-south component varying weakly between +6/- 5nT. Phi angle was positive (away from the Sun), but switched to negative at 05/1230 UTC. Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 persisted at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels with the associated 24-hour fluence well below Active. Observed fluence at 06/0000 UTC was 1.54e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate activity is likely to continue with occasional M-flares and a slight chance of X-class flares, these most likely from AR3697.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently expected. The next potential enhancement is most likely to be from CH42/+, which could bring slightly elevated or possibly elevated wind speeds later on Day 3 or perhaps more likely on Day 4 (08-09 Jun), although this is low confidence.

Overall, Quiet geomagnetic activity is expected, but with a chance of a spell of Unsettled to Active with a slight chance of G1/Minor Storms on Days 3-4 from any coronal hole fast wind onset.

Energetic Particles / Solar Radiation: High energy proton flux is expected to persist at background levels, with a slight chance of rising above the S1/Minor Radiation Storm

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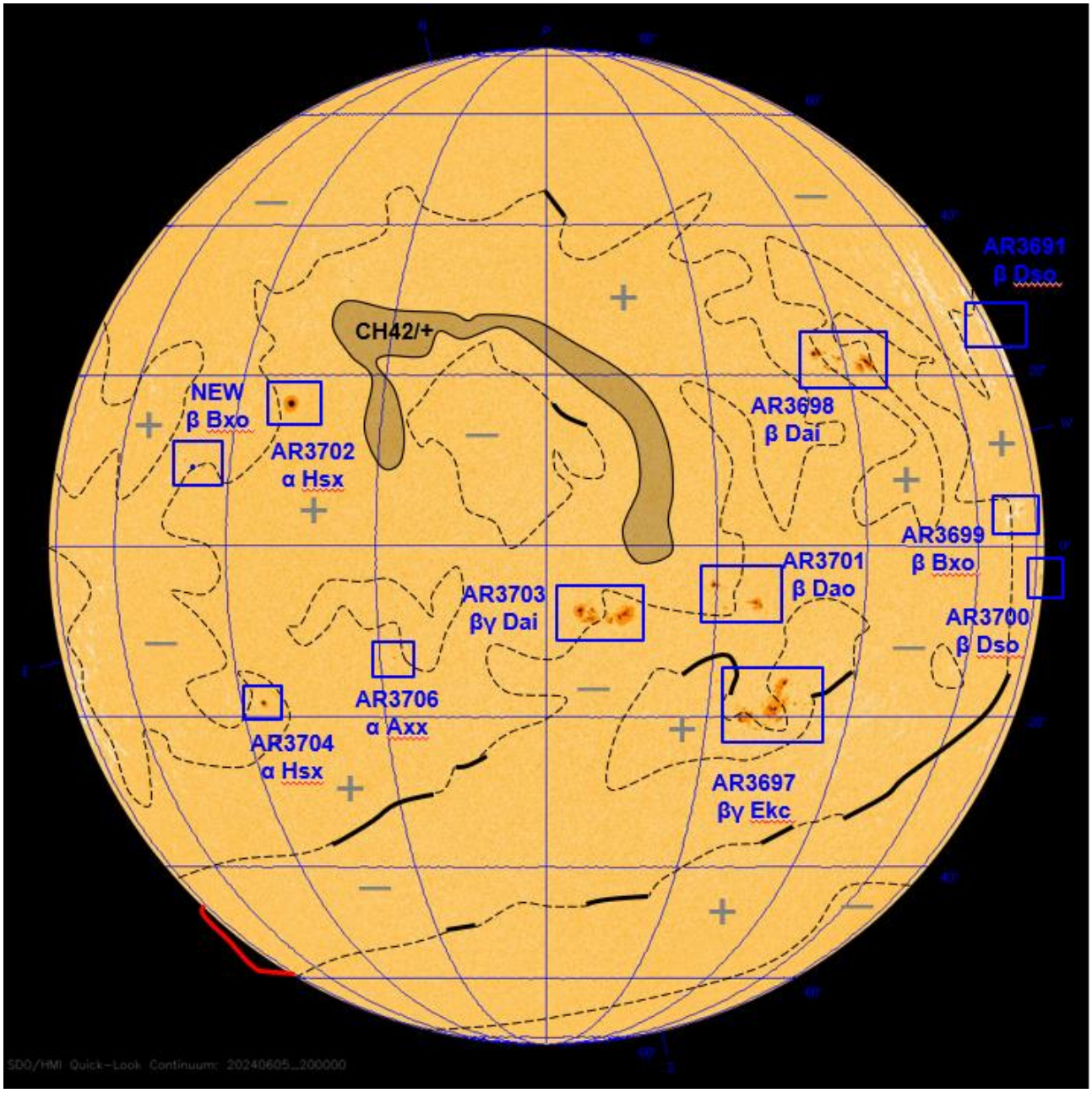
threshold given any notable flares. High energy electron flux is forecast to persist at background levels, with the associated 24 hour fluence forecast to remain below the Active threshold.

Figure 1. Solar Analysis Valid 05/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The CME from the M7.3 flare on 01/1940 UTC either gave a weak glance early on 05 Jun, or has now missed Earth. No other Earth-directed CMEs have been observed in available imagery.

Recent slightly elevated solar winds have now eased to background levels. The next potential enhancement is most likely to be from CH42/+ currently straddling north centre disc. This could bring slightly elevated or possibly elevated wind speeds later on Day 3 or perhaps more likely on Day 4 (08-09 Jun), however this is low confidence due to limited enhancement currently in MOSWOC Enlil and the lack of evidence from the previous rotation, which was dominated by the arrival of fast CMEs. Any geomagnetic response is expected to be limited at this time of year, however.

Overall, Quiet geomagnetic activity is most likely, but with potential for a spell of Unsettled to Active with a slight chance of G1/Minor Storms on Days 3-4 from any coronal hole fast wind onset.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

No Earth directed CMEs currently expected.

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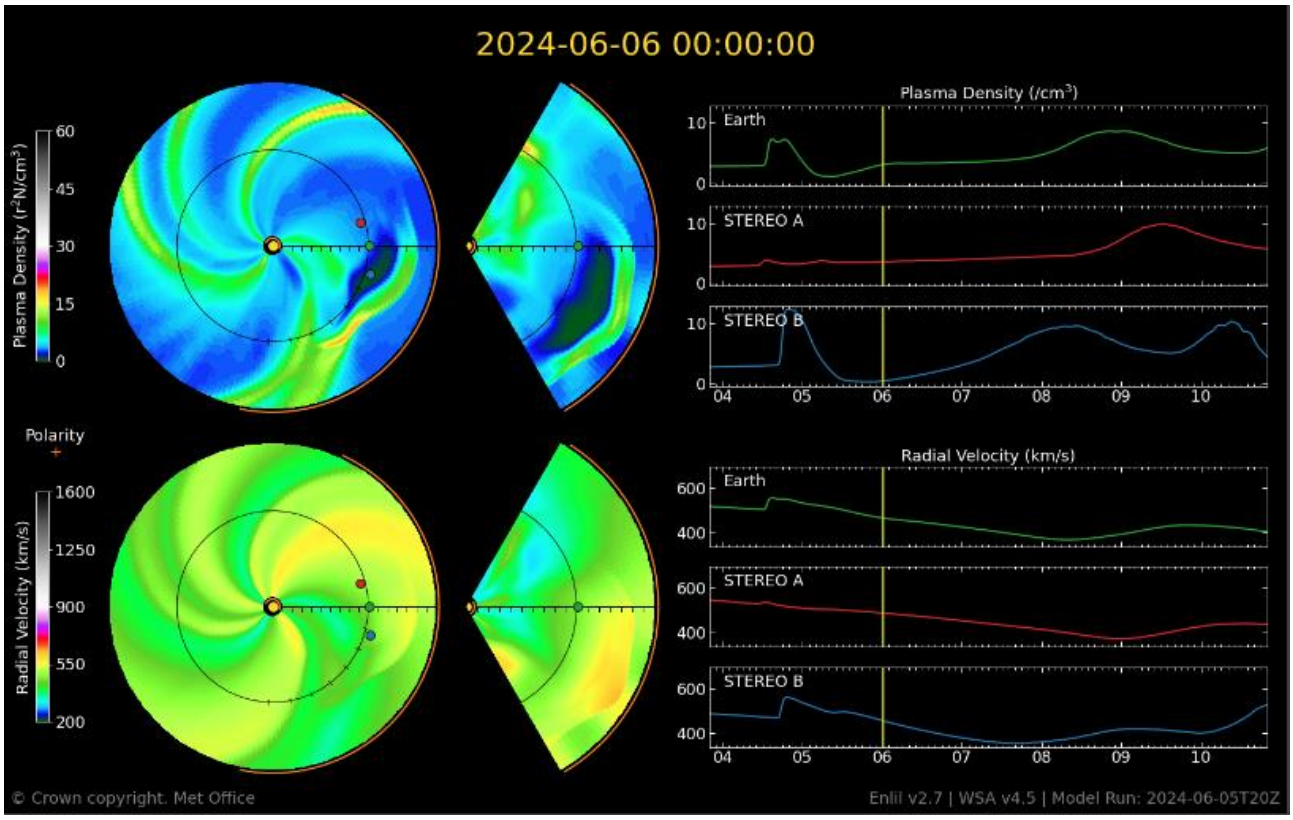
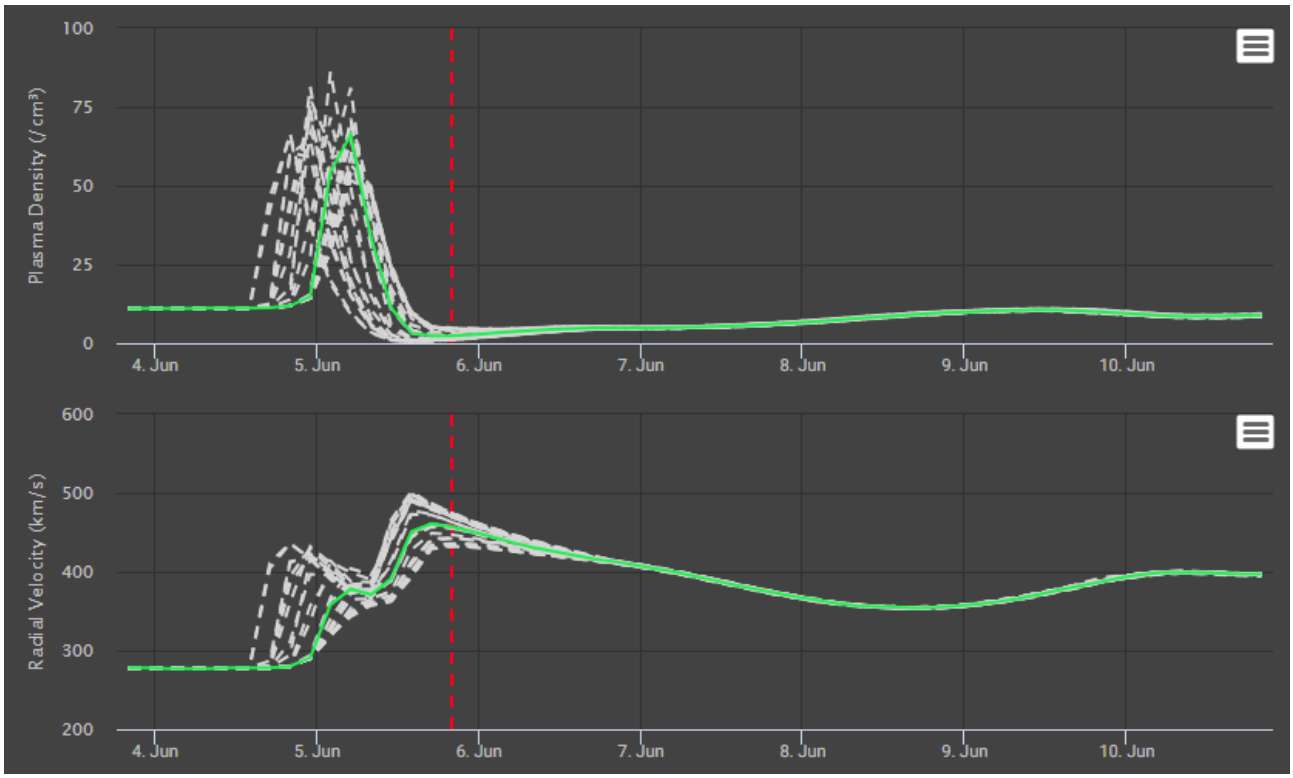
Figure 2: MOSWOC Enlil and ensemble, showing no further Earth directed CMEs currently expected. Enlil is too fast with the solar wind speeds at present, reducing confidence in its high speed stream forecast later in the period.





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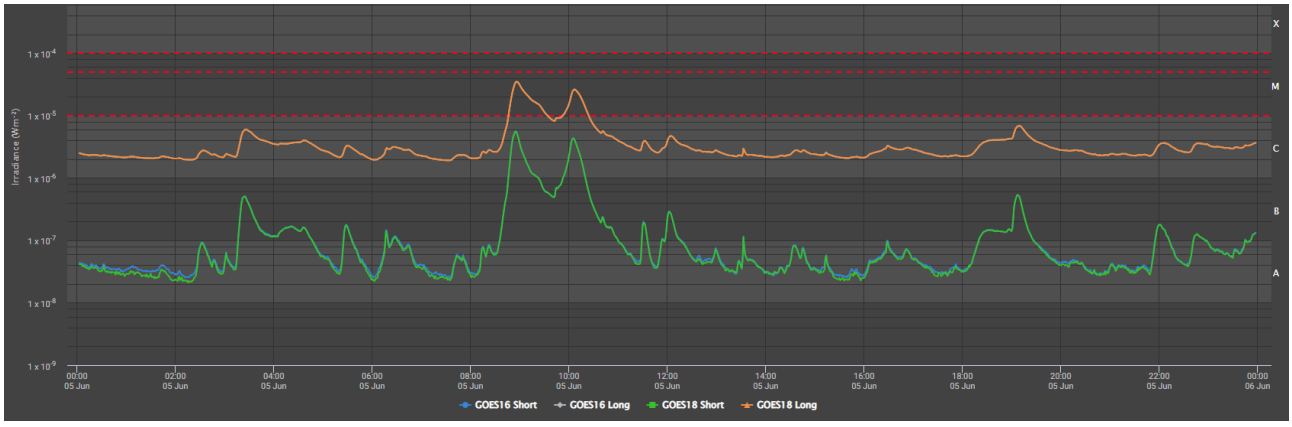
Radio Blackouts - X-Ray Flares:
Mainly Moderate activity is likely to continue with occasional M-flares and a slight chance of X-class flares. A slight reduction in risk is suggested near the end of the period as AR3698 rotates off the disc.

There are currently eleven sunspot regions on the visible disc. AR3697 remains the most complex region, with recent reconfiguration of the intermediate spots. In addition, there are suggestions it is trying to form a new delta region in the trailing area. Significant magnetic looping persists above the spot, and notable flares remain possible from this region. Some slight growth has also been observed in the intermediate region of AR3698 in the northwest, however this region currently remains stable. Growth of intermediate spots and an increase in magnetic flux has also been observed in AR3703, with this having developed a small delta spot in its trailing region. Some flaring and magnetic looping has been observed from the southeast limb, suggesting a potential new region could arrive in the next 24 hours or so. Across the rest of the disc the majority of spots remain simple and stable.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	70	70	70	60
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: X-ray flux at GOES 16 and 18, showing two M-flares from AR3697.



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Solar Radiation Storms - (High Energy Protons):
GOES-18 proton flux is currently at background levels. AR3697 is now much reduced compared to its previous active phase, but still contains the potential for further large M-class or perhaps X-class flares. Alongside the other active regions, the majority of which are in the western disc, this gives a slight chance of proton flux exceeding the S1/Minor Radiation storm level.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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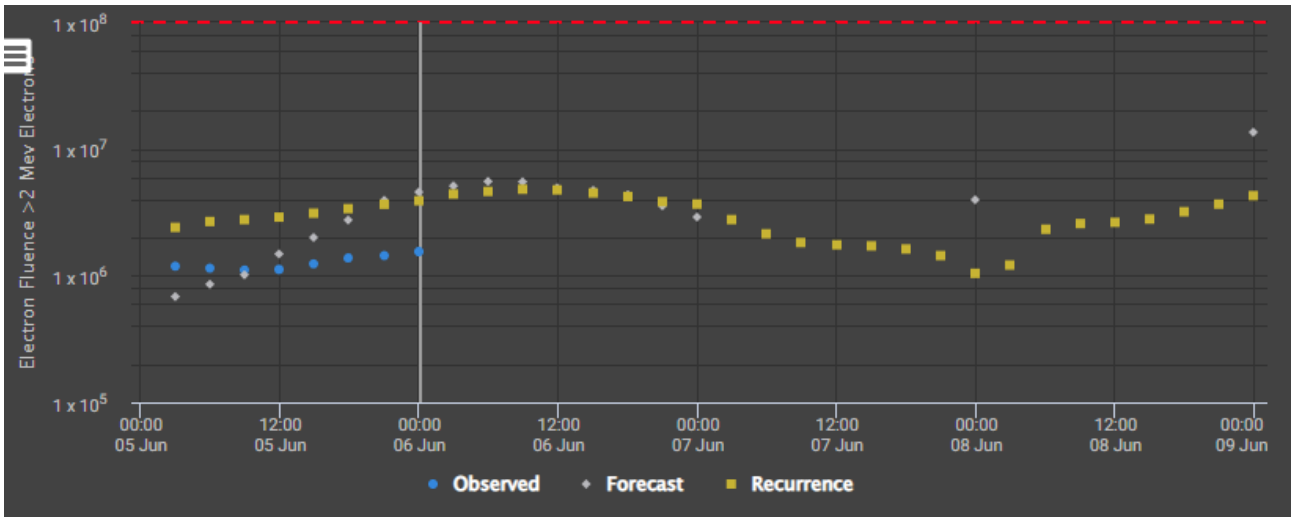
High Energy Electrons Event (≥ 2MeV):
The high energy electron flux, as observed by GOES-16, is expected to persist at mainly background levels, with no notable sources of potential enhancement currently anticipated. The associated 24 hour electron fluence is expected to remain well below the Active level. MOSWOC REFM is suggesting a slight increase in fluence later in the period, but this is currently thought to be unlikely to occur.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REFM showing a below Active forecast, although with a slight rising trend. This is currently considered unlikely to occur.



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